furnace must, therefore, be strongly heated by the hot gases; and this is not possible unless the nappe or free lower surface of the current of hot gases is in contact with the hearth of the furnace, or, as it is expressed in the shop, unless the flame *licks the hearth.*

This fact supplies the method by which reverberatory furnaces may be proportioned by computation. It is evident that, in furnaces working in the most satisfactory manner, the depth of the inverted gaseous stream must be equal to the height of the roof of the furnace above the hearth. Referring Lo Fig. 25, h represents this height.

The formula giving the depth of the gaseous stream has been established in a brilliant manner by J. C. Yesmann/[1]) to whom we are indebted for the mathematical study of this case. In his work/[2]> it is shown that the formula (Z>) cited for water, becomes for gases

in which h_t represents the depth or thickness of the layer of gas in motion; Q_t, the volume of gas flowing in cubic meters at the temperature t; B, the length of the weir over which the gas flows, the *inverted weir* (the width of the furnace).

The coefficient A is different for each value of h_t and the length B of the inverted weir. The values of these coefficients are given in the following table: ([4])

h_t=	0.30			0.50			0.75			1.00		
5 =	1.00	2.00	5.00	1.00	2.00	5.00	1.00	2.00	5.00	1.00	2.00	5.00
A=	3.42	3.54	3.62	3.29	3.46	3.57	3.13	3.37	3.54	2.97	3.28	3.53

According to this, in making the computation for a reverbera-tory furnace it is considered as an *inverted weir* of which the depth above the crest is determined by Yesmann's formula.

For the motion of the gases flowing through horizontal flues and under the straight horizontal roofs of continuous ingot heating furnaces, this formula will give results which very closely approach

those obtained in practice. For ascending roofs, the actual thickness of the layer of gas will be less than the value obtained

C1) *Eevue de la Societ& russe de Metallurgie, 1910, pp. 819-348, and Ann. de I'Inst. Polyt. de Petrograd, 1910,*

(2) *Refer to Appendix I.*

(3) For this formula in English units refer to p. 193.

<4) For coefficients in English units refer to p . 257.